

WHAT IS CLAIMED IS:

Sub A1 → 1. An early failure detection method for a flash memory system wherein the flash memory method designates a quantity of storage locations as spare locations, the spare locations being assigned for use as alternate storage locations in the event that defects occur, the early failure detection system comprising:

evaluating the quantity of spare locations available for assignment as alternate storage locations to determine if a threshold value has been reached; and

in the event that the quantity of spare locations reaches the threshold limit, taking a preemptive action to avert impending failure of the flash memory system.

2. A method of determining the usability of a solid-state storage device, wherein the solid-state storage device comprises spare storage locations for use in the event a defect occurs in other storage locations, the method comprising predicting the usability of the solid-state storage device based on the quantity of unused spare storage locations.

3. The method of claim 2, further comprising assigning a quantity of storage locations within a solid-state storage device to serve as spare storage locations in the event defects occur in the storage locations.

4. The method of claim 2, wherein the act of predicting the usability of the solid-state storage device comprises determining whether the quantity of unused spare storage locations is less than a predetermined threshold amount.

5. The method of claim 2, wherein the act of predicting comprises comparing the amount of unused spare storage locations to an original amount of spare storage locations.

6. The method of claim 2, wherein the act of predicting comprises monitoring the frequency of defects occurring.

7. The method of claim 2, wherein the act of predicting comprises monitoring the rate of change in the frequency of defects occurring.

8. The method of claim 2, wherein the act of predicting calculates a currently available amount of spare storage locations as a percentage of an initially available amount of spare storage locations.

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9. A method of monitoring the life expectancy of a flash memory device, wherein the solid-state storage device comprises spare storage locations for use in the event a defect occurs in other storage locations, the method comprising:

comparing the number of available spare locations with a predetermined threshold; and

performing an action when the quantity of unused spare storage locations falls below the predetermined threshold, so as to avoid the consequences of a potential failure of the flash memory.

10. The method of claim 9, further comprising assigning a quantity of storage locations within a flash memory device to serve as spare storage locations wherein the spare storage locations are used when defects occur in the flash memory device

11. The method of claim 9, wherein the predetermined threshold is stored in a controller in the flash memory device.

12. The method of claim 9, wherein the predetermined threshold is stored in a memory array associated with the flash memory device.

13. The method of claim 9, wherein the predetermined threshold is stored in a host system that stores data in the flash memory device.

14. The method of claim 9, wherein the predetermined threshold is calculated as a percentage of an initial number of spare storage locations available within the flash memory device.

15. The method of claim 9, wherein the predetermined threshold is calculated as a percentage of an average number of spare storage locations typically available within a flash memory device similar in memory capacity to the flash memory device.

16. A solid-state storage device comprising:

a plurality of storage locations;

a plurality of spare storage locations wherein the spare storage locations are used when defects occur in the storage locations; and

processor circuitry configured to predict the usability of the solid-state storage device based on the quantity of unused spare storage locations.

17. The solid-state storage device of claim 16, wherein the processor circuitry is further configured to send a notification regarding the usability of the solid-state storage device.

18. The solid-state storage device of claim 16, wherein the processor circuitry is further configured to display the quantity of unused spare storage locations.

19. The solid-state storage device of claim 16, wherein the processor circuitry is further configured to copy data from some storage locations to other storage locations.

20. The solid-state storage device of claim 16, wherein the processor circuitry is further configured to automatically enable the addition of supplemental storage locations for use by the solid-state storage device.

21. The solid-state storage device of claim 16, wherein the processor circuitry is further configured to enable a manual addition of supplemental storage locations for use by the solid-state storage device.

22. A flash memory device comprising:

a plurality of storage locations;

a plurality of spare storage locations;

a predetermined threshold value; and

processor circuitry configured to compare the number of available spare storage locations with the predetermined threshold, and wherein the processor circuitry is further configured to perform an action when the quantity of unused spare storage locations falls below the predetermined threshold, so as to avoid the consequences of a potential failure of the flash memory.

23. The flash memory device of claim 22, wherein the flash memory device is a flash memory card.

24. The flash memory device of claim 22, wherein the flash memory device is a flash memory chip.

25. The flash memory device of claim 22, wherein the flash memory device is an array of flash memory cards.

26. The flash memory device of claim 22, wherein storage locations can be dynamically allocated as spare storage locations.

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27. The flash memory device of claim 22, wherein the action performed by the processor circuitry allows for the use of other unused spare storage locations accessible by the flash memory device to serve as supplemental spare storage locations.

28. A method of determining the usability of a solid-state storage device, the method comprising:

✓ assigning a quantity of storage locations within a solid-state storage device to serve as spare storage locations wherein such spare storage locations are used when defects occur in the storage locations;

monitoring the number of available spare storage locations; and

performing an action when the quantity of unused spare storage locations falls below a desired amount, so as to avoid the consequences of a potential failure of the solid-state storage device.

29. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within the memory device.

30. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within a host system that uses the memory device to store data.

31. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within the controller of the memory device.

32. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within a peripheral controller.

33. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within a bus controller.

34. The method of claim 28, wherein monitoring the number of available spare storage locations takes place within any processor configured to monitor the memory device.

✓ 35. An early failure detection system for a digital data storage system that designates a quantity of storage locations as spares locations, the spares locations being assigned for use as alternate storage locations in the event that defects occur, the early failure detection system comprising:

evaluating the quantity of spares locations available for assignment as alternate storage locations to determine if a threshold value has been reached; and

in the event that the quantity of spares locations reaches the threshold limit, taking a preemptive action to avert impending failure of the digital data storage system.

36. The method of claim 35, wherein evaluating the quantity of spares locations available for assignment is carried out by referring to a counter that is incremented each time a new spares location is used.

37. The method of claim 35, wherein evaluating the quantity of spares locations available for assignment is carried out by counting all available spares locations at predetermined time intervals.

38. The method of claim 35, wherein evaluating the quantity of spares locations available for assignment is carried out upon request by a host system 102.

39. A system for determining the usability of a solid-state storage device, wherein the solid-state storage device comprises spare storage locations for use in the event a defect occurs in other storage locations, the system comprising:

means for monitoring the number of available spare storage locations; and

means for performing an action when the quantity of unused spare storage locations falls below a desired amount, so as to avoid the consequences of a potential failure of the solid-state storage device.